

REMARKS

Reconsideration of this application in view of the above amendments and following remarks is respectfully requested.

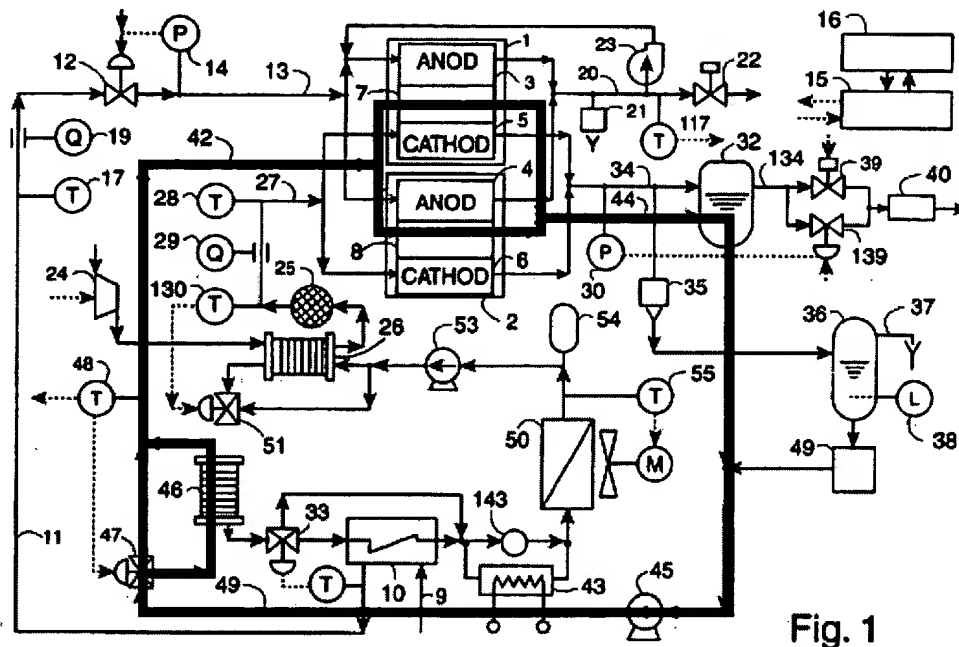
Claims 1-8 are currently pending. Claims 1-8 have been amended. No claims have been canceled or added.

As a preliminary matter, Applicants have made a number of grammatical and/or stylistic changes to claims 1-8 (such as replacing "said" with "the", and providing proper antecedent basis for various elements). In addition, Applicants have corrected a typographical error in paragraph [0013] of the specification. In particular, reference to "a cooling medium" was omitted in the last sentence of this paragraph. Applicants submit that this typographical error is readily apparent in view of the content of this paragraph, and that this change does not constitute addition of new matter.

Claims 1 and 4-8 stand rejected under 35 U.S.C. §102(b) as unpatentable over U.S. Patent No. 5,605,770 to Andreoli et al. (hereinafter "Andreoli"). Applicants respectfully traverse this ground of rejection.

Andreoli is directed to a supply system for fuel cells that includes both primary and secondary cooling circuits. The primary cooling circuit (referred to in the specification of Andreoli as "the primary cooling and humidification circuit") is depicted below by the bolded line. This circuit operates on demineralized water (*see* col. 4, line 51-52) and delivers the same via manifold 42 to cooling sections 7 and 8 of the fuel cell, then onto manifold 44, pressuriser 32, recycling pump 45, and valve 47. Valve 47 is controlled by temperature sensor 48, which controls delivery of the demineralized water back to manifold 42. Valve 47 maintains the temperature of the demineralized water in manifold 42 at about 70°C by controlling the passage of the demineralized water through heat exchanger 46. (Operation of the primary cooling circuit is set forth in greater detail at col. 4, line 51 through col. 5, line 26 of the Andreoli specification.)

"Primary Cooling Circuit"



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In addition to the primary cooling circuit discussed above, Andreoli also discloses a secondary cooling circuit. This circuit (referred to in the specification of Andreoli as "the secondary cooling system") is depicted below by the bolded line. This secondary system serves three purposes; namely, it removes heat from the primary cooling system (via heat exchanger 46), (2) cools the air from compressor 24 (via heat exchanger 26) and (3) heats the hydrogen fuel to its working temperature (via heat exchanger 10). More specifically, the secondary cooling circuit is a closed circuit containing water and glycol, which circulates in radiator 50 and is fan cooled. It passes to recycling pump 53 and then onto plate exchanger 26 to cool the combustion air coming from compressor 24, with the amount of such cooling being controlled by valve 51. Although not properly depicted in Figure 1 of Andreoli, the water/glycol mixture then passes through water/water plate exchanger 46 wherein the demineralized water of the primary cooling circuit is cooled. From exchanger 46, the water/glycol mixture passes to the water/hydrogen plate exchanger 10, which serves to heat the hydrogen in an amount regulated by valve 33. From exchanger 10, the water/glycol mixture returns to radiator 50 through ball valve 143 which also

permits passage of the water/glycol mixture through electric heater 43. (Operation of the secondary cooling circuit is set forth in greater detail at col. 5, line 27 through col. 6, line 35 of the Andreoli specification.)

"Secondary Cooling Circuit"

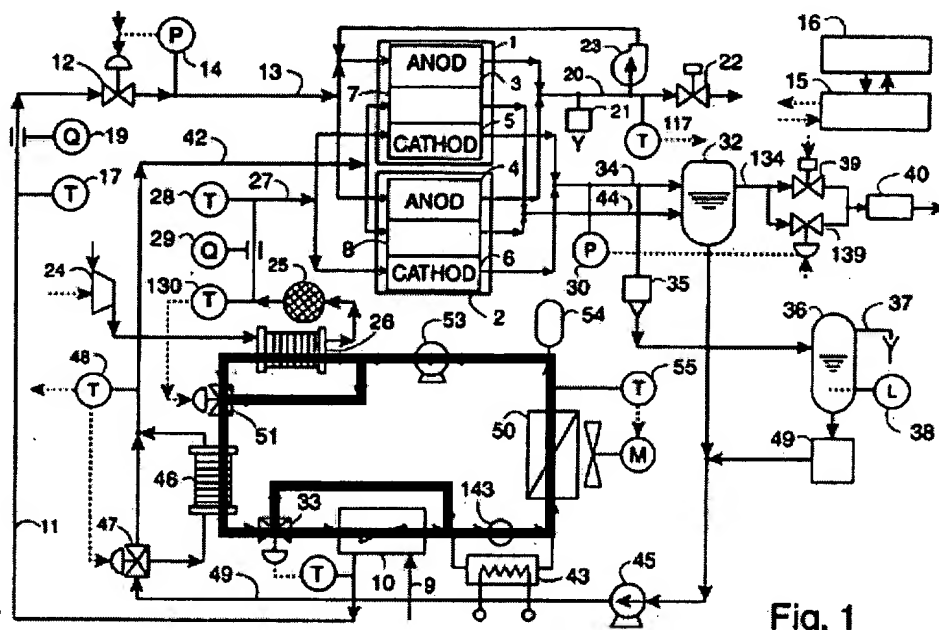


Fig. 1

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The present invention is quite distinct from the fuel cell supply system of Andreoli having both primary and secondary cooling circuits. In particular, pending claim 1 of the pending application recites, among other elements, a cooling circuit for cooling the fuel cell and a heating circuit for heating cryogenic medium (such as liquid hydrogen), wherein the heating circuit is coupled directly to the cooling circuit. As explained in the specification at, for example, paragraph [0014], the phrase "coupled directly" means that the same medium is used for cooling the fuel cell and for heating the cryogenic medium.

This distinction can also be seen by reference to Figure 1 of the pending application. More specifically, fuel cell 2 has a cooling circuit which includes heat exchanger 9 (e.g., a radiator). The cooling medium is circulated through the fuel cell in lines 4 and 5 via

pump "P". A heating circuit is also provided that further includes lines 6, 7 and 8 (in addition to radiator 9 and lines 4 and 5), which circuit directs the same medium through heat exchange 3 to heat the incoming hydrogen for the fuel cell. Thus, the cooling medium of the cooling circuit is the same medium as the heating medium of the heating circuit.

As noted in paragraph [0006] of the pending specification, this has the advantage that the small amount of waste heat generated by a fuel cell having a low operating temperature is itself sufficient to vaporize the cryogenic medium (*e.g.*, liquid hydrogen). In this manner, a reduction in the size, weight and cost the cooling system can be achieved.

Andreoli does not teach directly coupling the heating circuit to the cooling circuit as recited in the pending claims, and thus does not anticipate any of the pending claims. Furthermore, this reference does not suggest or motivate such a combination of elements. In fact, great effort is made in Andreoli to keep the primary and secondary cooling circuits as distinct systems, especially since they operate under different pressures and with different mediums.

Accordingly, Applicants submit that the pending claims are both novel over, and nonobvious in view of, the Andreoli patent. Furthermore, the addition of the secondary references cited by the Examiner – that is, U.S. Patent Nos. 6,647,698 to Gaarder et al. and 4,004,947 to Bloomfield – do not cure this deficiency. In particular, neither of these references teach or suggest directly coupling the heating circuit to the cooling circuit (as recited in pending claims 1-7), nor transferring heat from the cooling medium to the cryogenic medium by means of a heat exchanger by causing cooling medium to flow through the heat exchanger (as recited in pending claim 8).

In view of the above amendments and remarks, Applicants respectfully submit that claims 1-8 are patentable over the cited prior art, and request that these grounds of rejection be withdrawn. A good faith effort has been made to place this application in condition for

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allowance. However, should any further issue require attention prior to allowance, the Examiner is requested to contact the undersigned at (206) 622-4900 to resolve the same.

Respectfully submitted,

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